

HELLENIC REPUBLIC  
MINISTRY OF DIGITAL GOVERNANCE



**HELLENIC CADASTRE**

# National Report of Greece

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# Outline

1. **Upgrade of HEPOS to full GNSS**
2. **Displacements induced by earthquakes**
  - The 2020 Samos, east Aegean Sea earthquake
  - The 2021 Ellassona, Central Greece earthquake

# Upgrade of HEPOS to full GNSS

## Overview



- 98 reference stations
- Single-Base & Network RTK
- Post Processing: RINEX, VRINEX
- Official system for Cadastral Surveys
- ETRS89 realization in Greece, endorsed by EUREF
- More than 1200 users & 1700 user licenses

# Upgrade of HEPOS to full GNSS

## Timeline



- 2007: Established (*co-funded by the EU*)
- 2008: Initial operation
- 2009: Available to the community
- **2020: Upgrade to full GNSS** (*national funds*)

# Upgrade of HEPOS to full GNSS

## Project details

- Upgrade of Receivers & Antennae
- Upgrade of Control Center
- Personnel training
- Testing
- Maintenance of the complete network for 3.5 years
- Technical support for 3.5 years
- Budget 2 M€

# Upgrade of HEPOS to full GNSS

## Upgrade of Receivers & Antennae

	Initial network	After Upgrade
Receivers	Trimble NetRS ( <i>GPS only</i> )	Trimble Alloy ( <i>full GNSS</i> )
Antennae	Trimble Zephyr geodetic	Trimble Zephyr geodetic 3



# Upgrade of HEPOS to full GNSS

## SUPPORTED GNSS SIGNALS

- **GPS:** L1, L2, L2C, L5, L1C
- **GLONASS:** G1, G2, G3
- **Galileo:** E1, E5a, E5b, E5alt-BOC, E6
- **BEIDOU:** B1, B2, B3
- **SBAS:** EGNOS-WAAS-GAGAN: L1C/A, L5





# Upgrade of HEPOS to full GNSS

## Upgrade of Control Center

	Before Upgrade	After Upgrade
Software	Trimble GPSNet	Trimble PIVOT
Server redundancy	Partial	Full

### Selected features of upgraded software:

- Full GNSS (RTCM 3.2, MSM 3-7)
- Individual station velocities
- Customizable user subscriptions
- GDPR compliant
- Users can: change password & personal data, view subscription details, ...

# Upgrade of HEPOS to full GNSS

## Project Challenges

- Upgrade during operation (no down time)
- Short upgrade time (9 months)
- Upgrade during COVID-19 strict lock-down measures
- Coordinates backward compatible
- Run in parallel with renewal of telecom network



# 2 Displacements induced by earthquakes

## Preface

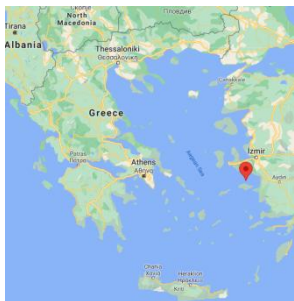
In the context of operating HEPOS and maintaining the reference system, geological phenomena that may lead to coordinate changes are being investigated.

This report presents the results obtained from the study of two important geological phenomena:

- The 2020 Samos, east Aegean Sea earthquake
- The 2021 Ellassona, Central Greece earthquake

# 2.1 The 2020 Samos earthquake

## The event



The 2020 Samos, east Aegean Sea earthquake:

- **Day:** October 30, 2020
- **Mw:** 7.0
- **Depth:** ~13 Km
- Associated with a tsunami
- Significant permanent displacements

## 2.1 The 2020 Samos earthquake

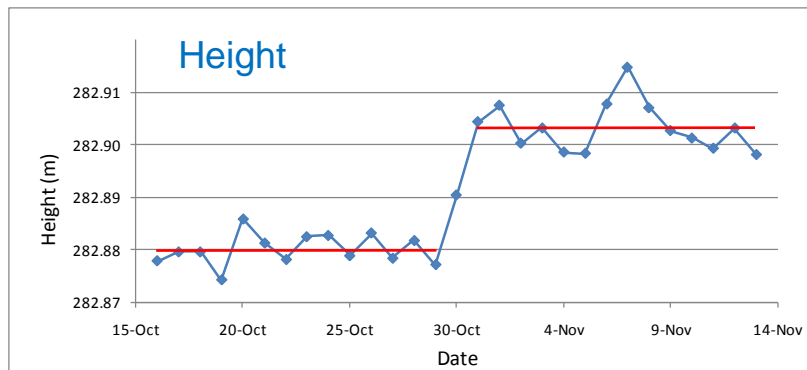
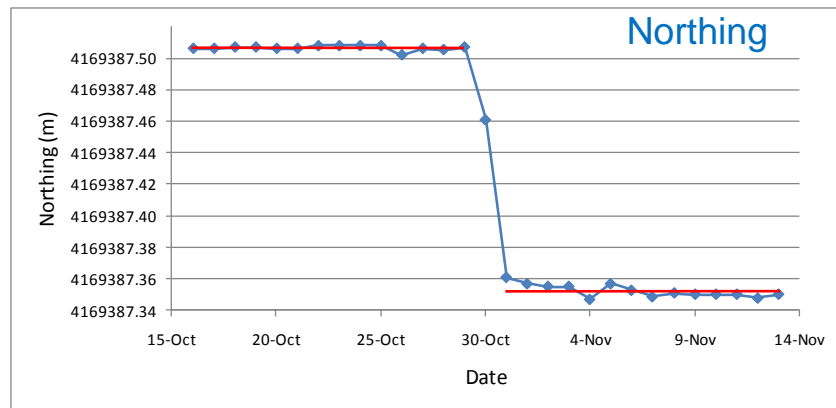
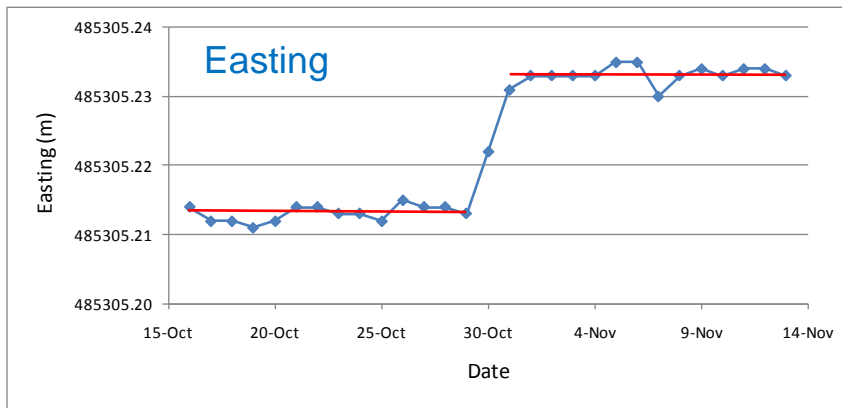
### Dataset - data processing

- **Data:** GPS daily files from HEPOS stations 093A, 094A, 095A
- **Data span:** 2 weeks before/after EQ
- **Method:** PPP
- **Software:** CSRS-PPP
- **Orbits and Clocks:** Final
- **Elevation mask:**  $7.5^\circ$
- **Ambiguities:** Fixed
- **Reference frame:** ITRF(IGb14)



# 2.1 The 2020 Samos earthquake

## Obtained time-series: station 093A



# 2.1 The 2020 Samos earthquake

## Estimated static displacements



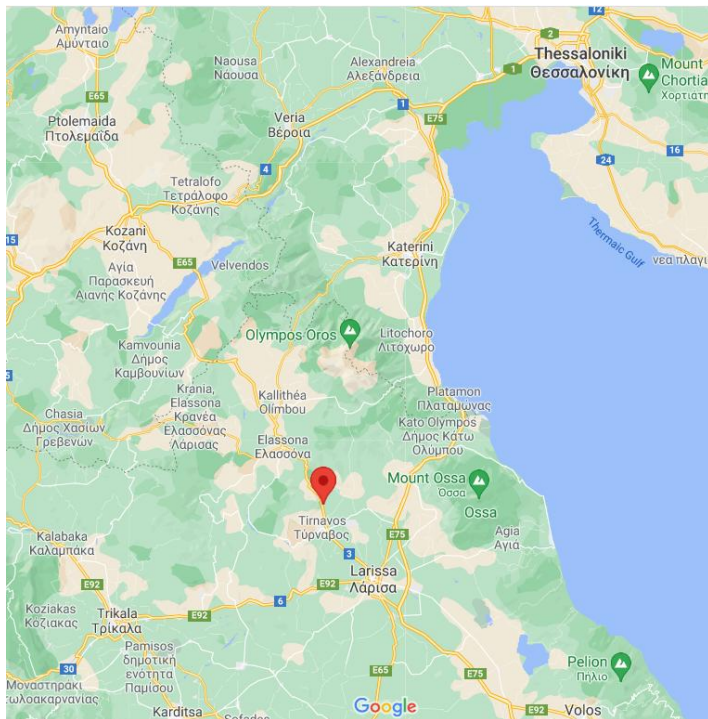
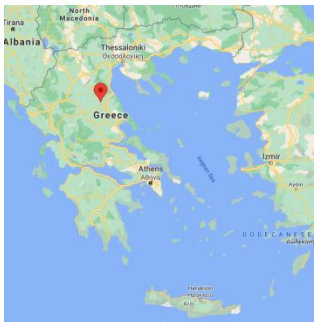
Station	Length of slip vector (cm)
093A	15.5
095A	2.6
094A	1.9

# 2.2 The 2021 Ellassona earthquake

## The events

The 2021 Ellassona, Thessaly Central Greece main events:

- **Days:** March 3 & 4, 2021
- **Mw:** 6.3 & 6.1
- **Depth:**  $\approx 10$  Km
- Moderate permanent displacements

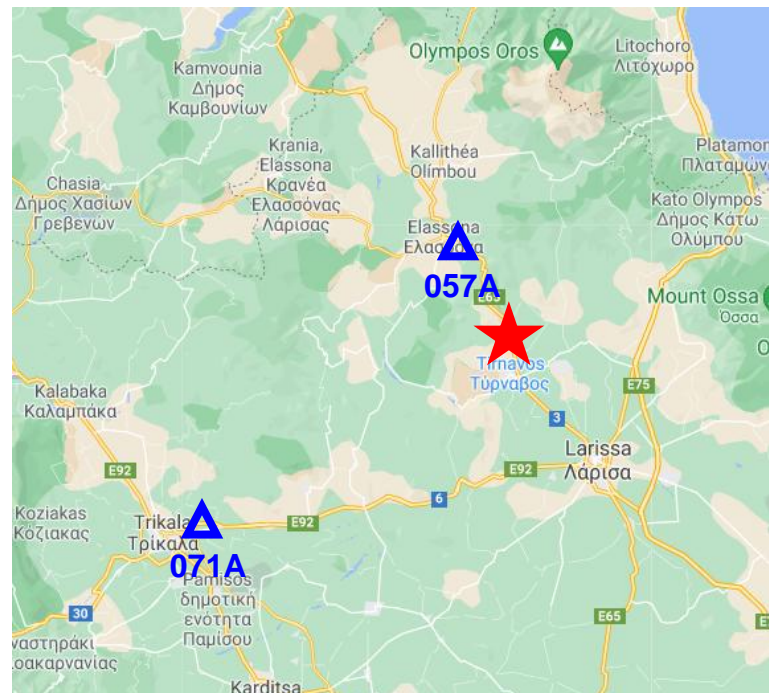




## 2.2 The 2021 Ellassona earthquake

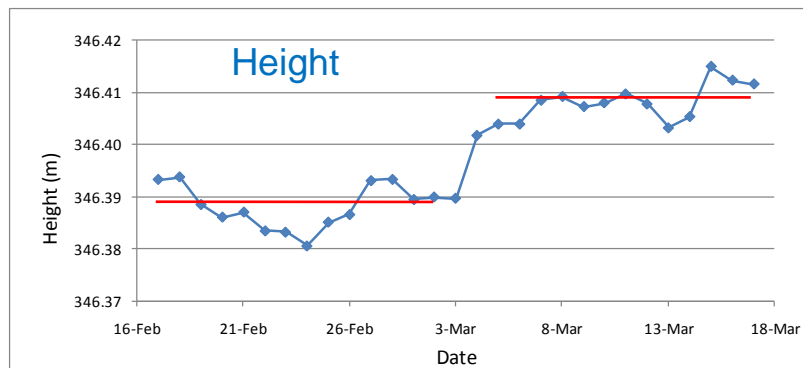
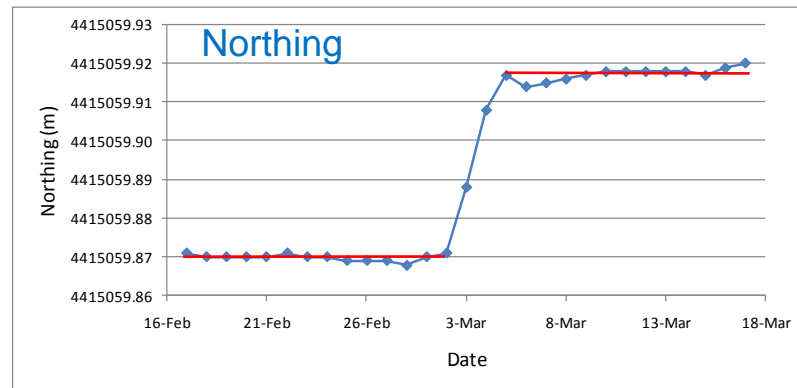
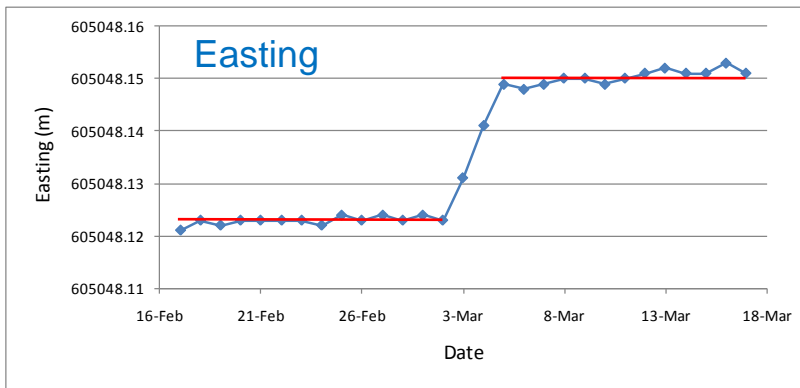
### Dataset - data processing

- **Data:** GPS daily files from HEPOS stations 057A, 071A
- **Data span:** 2 weeks before/after EQ
- **Method:** PPP
- **Software:** CSRS-PPP
- **Orbits and Clocks:** Final
- **Elevation mask:**  $7.5^\circ$
- **Ambiguities:** Fixed
- **Reference frame:** ITRF(IGb14)



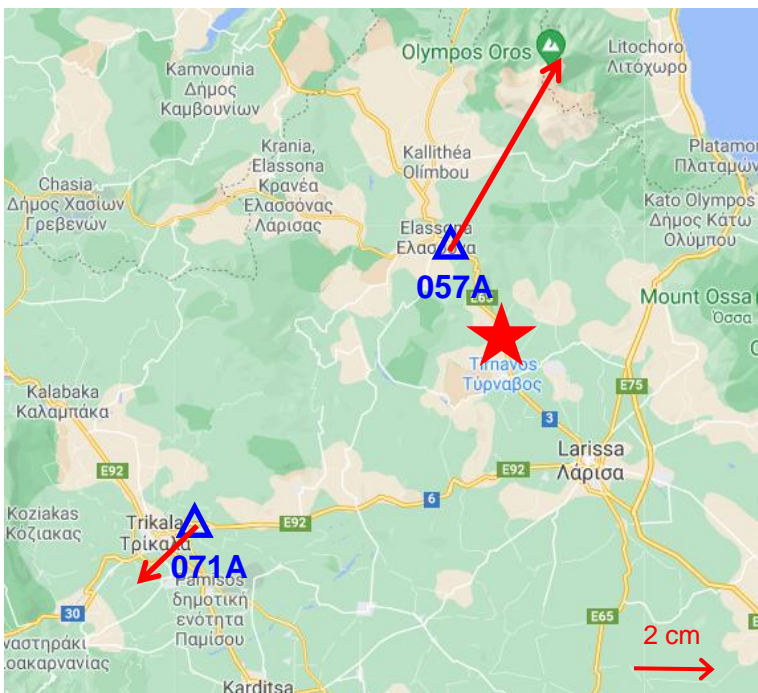
# 2.2 The 2021 Ellassona earthquake

## Obtained time-series: station 057A



# 2.2 The 2021 Ellassona earthquake

## Estimated static displacements



Station	Length of slip vector (cm)
057A	5.5
071A	2.1

# Acknowledgments

*Thank you for your attention!*



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